DISTRIBUTION AND ABUNDANCE OF STEELHEAD AND COHO IN GAZOS CREEK

Jerry J. Smith
26 December 2001

Gazos Creek has been sampled in late summer or fall by backpack electroshocker for steelhead (*Oncorhynchus mykiss*) and coho salmon (*O. kisutch*) since 1992. The sampling was initially less intensive than sampling that began in Scott and Waddell creeks, Santa Cruz County, in 1988 (Smith 1992-2000), but is now similar. In 1992 only two Gazos Creek sites, both downstream of Old Woman's Creek, were sampled, but 4-5 sites were sampled in 1993-1997 and 8-9 sites were sampled in 1998-2001 (Table 1). At each site the same individual habitats were sampled, if possible, so that year-to-year site densities are an index to annual differences in spawning success and rearing conditions. However, since the primary reason for the sampling was to determine the distribution and abundance of coho, the sampling has been biased towards the pools that coho heavily use. Although pools make up 30-40 percent of available habitat at most sites, they have made up 44 to 79 percent of sampled habitat. The capture rates of young-of-year (YOY) steelhead, which potentially use all habitat types, may not be proportionally affected by year to year rearing conditions. In particular, YOY steelhead probably decline somewhat more in dry years, when riffles are very shallow, than indicated by sample results. This report summarizes sampling results for Gazos Creek and their implications for status and habitat relationships of steelhead and coho in the watershed.

Background: Steelhead and Coho Ecology

Juvenile steelhead normally spend 1-2 years in fresh water before smolting (physiologically changing in preparation for salt water) in late March through May and migrating to the ocean (Shapovalov and Taft 1954). Regular smolting as yearlings normally occurs only where fish are able to grow to relatively large size (100 mm) in their first summer. The central coast habitats that provide for such rapid growth include productive lagoons at the mouths of streams (Smith 1990), and stream reaches with high summer stream flows due to natural conditions (San Lorenzo River Gorge) or augmented summer flows downstream of reservoirs (Uvas Creek and the Carmel River). Juvenile steelhead feed in the current on drifting insects, if velocities are sufficient, but potentially use a wide range of habitats for rearing, including pools, runs and riffles. When food is scarce or metabolic needs are high, due to high water temperatures, steelhead may be found primarily in riffles or at heads of pools where food is more abundant (Smith and Li 1983).

Scale analysis of steelhead smolts and adults from Waddell Creek and the San Lorenzo River indicates that steelhead less than 75 mm are unlikely to smolt and enter the ocean as one year old fish (Smith, unpublished data). Yearling steelhead abundance is therefore a better indicator of potential adult steelhead abundance in most streams than is YOY abundance. Larger juvenile steelhead (primarily yearlings) usually rear in summer in habitats with deeper water and with good escape and overhead cover, such as undercut banks, overhanging vegetation and surface turbulence. Because of their more restrictive summer habitat requirements, and because they have had to survive the high flows of one or more winters, yearling and 2-year old steelhead are usually rare (10-25%) compared to YOY steelhead (Smith 1992-2000).

Juvenile and adult steelhead have broad tails and more muscular bases to their tails than salmon and are more powerful swimmers. Adult steelhead can often swim or jump over barriers that coho are unable to surmount. In Waddell Creek adult steelhead regularly ascend Slippery Falls on the West Fork, although coho apparently do not (Smith 1994a and 1996b). Because of their swimming ability, and ability to use a wide range of habitat types for rearing, steelhead are found throughout accessible portions of watersheds, including in channels steeper than 4-10%.

Steelhead mature and return to spawn after 1-2 years in the ocean. In small coastal streams, such as Waddell Creek, most first return after 1 year (Shapovalov and Taft 1954 and Smith, unpublished data). Many spawning steelhead, especially females, survive and return in successive years. Because of the variation in ages of smolting and maturation, and the ability to reproduce multiple times, the number of returning adult steelhead in a stream reflects stream conditions for the previous 2-4+ years, rather than a single year. Therefore, except in prolonged drought (1987-1991) or wet (1995-1998) periods, adult numbers probably vary relatively little from year to year. Adult steelhead also spawn over a rather extended period, from January through April, and spawning success for a portion of adults is good even in years of severe storms which destroy January and February nests. Therefore, juvenile steelhead abundance in most small streams appears to reflect year to year differences in rearing conditions, rather than variation in adult abundance or spawning success.

Coho have both a rigid life history and restricted habitat use compared to steelhead. Coho in Waddell Creek, and probably most of the central coast, always spend a single year in freshwater, and all wild females mature after 2 years in the ocean (Shapovalov and Taft 1954). Coho also die after maturing. Therefore, each of 3 successive coho year classes is numerically independent. Natural disasters, such a drought (which blocks adult or smolt migrations) or storms (which destroy coho nests or overwintering juveniles) can affect not only one year's production, but may result in weak or missing year classes 3, 6 and 9 or more years later. Even generally healthy populations of coho, like that of Redwood Creek in Marin County, can have a weak year class every 3 years (Smith 1994b, 1997, 2000a). Coho spawn during a brief period early in winter (mid-December through February), and are thus much more likely to have many or most nests damaged by winter storms. Surviving fry do emerge from the gravels earlier than steelhead, giving them a substantial growth and size advantage over steelhead in milder years (Smith

1994a, 1996b and 1999). However, spring storms can wash the early-emerged fry from stream reaches without backwaters or other complex habitats.

Rearing juvenile coho use primarily pools, especially those with complex escape cover (Smith 1994a, 1996b, 1998a, 1998b, 1999). Juvenile coho can use deep bedrock pools in summer, but vacate these simple habitats with the first significant winter storms. Even at sites where summer coho densities are very high they are rarely found in runs and are absent from riffles (Smith 1998b, 1999). Coho have only been found in steeper reaches (2-3.5%) in the Scott Creek watershed when winters have been relatively mild (1993 and 1996). In storm years (1995, 1997, 1999) juvenile coho have been absent or scarce in the steeper reaches, even when they were common in low gradient (<2%) reaches (Smith 1995b, 1998a, 1999). Even in years when coho have been found in higher gradient reaches, their overall density there has been extremely low, because of a scarcity of deep, complex pools in those steeper channels (Smith 1994a, 1996b).

Gazos Creek Steelhead YOY

Summer stream flows are low (< 1-2 cfs) in Gazos Creek, most habitats are heavily shaded, and YOY steelhead show little growth in late summer. Fish tend to be somewhat larger downstream (Figures 1 & 2), possibly due to slightly warmer water and earlier fry emergence from the gravels downstream. Regardless of the site, most YOY steelhead in the stream are less than 75 mm long standard length (SL) after one summer (Figures 1-3); few Gazos Creek steelhead probably smolt as yearlings. YOY at upstream sites (3-7) on Gazos Creek have generally shown little variation in growth from year to year, despite substantial differences in summer stream flow (Figure 3). Similar upstream sites on Scott and Waddell creeks also rarely show much difference in YOY steelhead growth among years (Smith 1992-2000). However, in 2001 rainfall ceased early and stream flows dropped quickly; fish sizes in Gazos Creek were smaller than in 2000, when summer stream flows were relatively high (Figures 1 & 2). At sites downstream of Old Woman's Creek (sites1-2), YOY sizes have varied from year to year (Figure 3). However, the changes were apparently unrelated to summer stream flow; fish were smallest in 1998, the wettest sample year. The amount of fine sediment in and on the channel bed may be a major factor in fish growth downstream of Old Woman's Creek. In 1998 logjam removal and a late storm resulted in a surface coating of silt in lower Gazos Creek (Smith 1998c). Similarly, in several other years (1996, 1997 and 1999) late storms resulted in substantial very fine sediment from Old Woman's Creek coating much of the channel downstream (Smith 1996b, 1998a, 1999). Aquatic insect production and availability as fish food may have affected YOY steelhead growth and abundance in those years.

Highest YOY steelhead abundance overall in Gazos Creek and at most individual sites has been in the years of highest summer stream flow, 1995, 1998 and 1999 (Table 1). Higher summer stream flow probably results in better YOY summer feeding and late summer survival. In addition, higher stream flows allow YOY steelhead to make greater use of run and riffle habitats, which are mostly too shallow by late summer in low flow

years. Similarly, highest YOY abundances on Scott and Waddell creeks were in 1995 and 1998 (Smith 1995b, 1998c). Flows were also high on those 2 streams in 1999, but YOY steelhead densities were lower because of an apparent fish kill on Waddell Creek and apparent competition from abundant coho on Scott Creek (Smith 1999).
YOY steelhead abundance downstream of Old Woman's Creek has generally been substantially below that of upstream sites (Table 1). Although flows are generally somewhat higher, channel substrate is generally sandier and is also frequently coated with more silt downstream of Old Woman's Creek. Substrate quality may be reducing YOY steelhead by reducing food for rearing fish and/or by reducing spawning attempts or success at downstream sites. Only in 1995 were YOY densities high downstream of Old Woman's Creek (Table 1). In that year substrate conditions were generally good throughout the stream and summer stream flows were also relatively high.

Among and within sites YOY steelhead abundance has generally been lower in very shady locations (canopy closures of 95+%). This is presumably because algae and aquatic insect abundance is lower, and because sight feeding on drifting insects is difficult for steelhead in very shady habitats. Sites downstream of Old Woman's Creek are very densely shaded by alders, which may partially account for lower YOY steelhead abundance there. In addition, highest downstream densities in 1998 were in habitats partially opened by fallen trees (Smith 1998c). Highest canopy closures upstream of Old Woman's Creek are at sites 2A, 5, and portions of 3A, which usually had lower YOY steelhead densities than slightly more open sites (Table 1). At those sites, and at other upstream sites, individual habitats that were more open (<90% canopy closure) usually had substantially higher YOY steelhead densities than similar densely shaded habitats. Sites with dense alder canopy (sites 1-2A) are not as "dark" as evergreen sites with similar canopy closures, because the evergreen canopies are generally much denser and occur with much steeper canyon slopes. In addition, sites with primarily deciduous alder canopy are much more open from November through March, potentially allowing improved feeding in late fall and early spring.

Juvenile steelhead are present in the lower reaches of Old Woman's Creek, a very small sandy tributary at mile 2.05. The tributary is apparently not a significant spawning or rearing habitat, but is instead important primarily as a source of fine sediment and turbidity impacting the lower portion of Gazos Creek.

From 1993 through 2001, when 4-9 sites were sampled on Gazos Creek, overall YOY densities have varied by only slightly more than a factor of 2 (29 to 68 per 100 feet of sampled habitat) (Table 1); most years varied substantially less (34 to 53). Mean densities have been consistently lower than in Scott and Waddell creeks, which are larger streams, but have been similar to upstream and tributary habitats in those 2 watersheds. The relatively high, stable abundances of YOY steelhead over the years in all three streams indicate that adult steelhead numbers and spawning success have probably not been a problem. However, the relatively low YOY numbers at the upper 2 sites on Gazos Creek in 2001 (Table 1) may indicate poor adult access or spawning success, due to lack of late winter storms.

Gazos Creek Steelhead Yearlings

Yearling steelhead abundance has shown no consistent patterns among sites in Gazos Creek (Table 1) (Smith 1992-2000). Even sites with generally low YOY abundance, such as downstream of Old Woman's Creek, have usually had yearling abundance similar to other sites. The high proportion of yearlings among captured steelhead reflects the over-representation of pools in sampled habitats throughout the stream. This is consistent with results on Scott and Waddell creeks, where the abundance and quality of pools regulate site abundance of yearling steelhead.

Year to year changes in yearling densities have varied by more than a factor of 2 (6-14 per hundred feet), but tended to be lower at most sites and overall for Gazos Creek between 1997 or 1998 and 2000 (Table 1). Similar declines have occurred in Scott and Waddell creeks between 1997 and 2000 (Smith 2000b), and suggest a common cause or causes. Winter storms were particularly severe in 1997, 1998, 1999 and 2000, which may have substantially reduced overwinter survival of juvenile steelhead. However, there were 2 severe storm periods in 1995, but yearlings were relatively abundant in all three streams in that year (Table 1 and Smith 1998a and 2000b). In addition to winter storms, the recent wet years have had increased spring stream flows, which may have increased spring growth by yearlings, resulting in smolting by a higher proportion of yearlings than during drier periods. The winter of 2000-2001 was relatively mild (which might have increased yearling survival), and spring stream flows declined quickly (which should have reduced spring growth and early smolting). Gazos Creek yearling abundance in fall 2001 rebounded and was relatively high due to either or both of these two factors. Unfortunately, distinguishing between a possible adverse impact (winter mortality) and a beneficial impact (improved growth and yearling smolting) of high flow years is not possible from fall sampling of juveniles.

Gazos Creek Coho

Only 1 in 3 coho year classes (1993, 1996, 1999) is now present on Gazos Creek (Table 2). Another (1992, 1995, 1998) was very weak, but was absent in 2001. The third year class (1997, 2000) is also missing. The situation is similar on Waddell Creek, where 1 year class has been somewhat common (1993, 1996, 1999), one is very weak (1992, 1995, 1998, 2001), and one is missing (1994, 1997, 2000). The situation is substantially better on Scott Creek, where 2 year classes are weak, but 1 (1993, 1996, 1999) has remained very strong (Smith 2000b). This wide variation in coho year to year abundance in the 3 streams apparently represents the impacts of severe droughts and floods over the last 18-25 years (Smith 1994c, 2000b). In 1998 juvenile coho abundance on all three streams was so low that adult returns in winter 2000/2001were unlikely. The presence of juvenile coho in Scott and Waddell creeks in 2001 may have been due to precocial returns of fish reared at the Big Creek Hatchery in the Scott Creek watershed.

Prior to 1998 and 2000 the Scott Creek coho population had been artificially brought back to the point where all 3 year classes were viable, due to hatchery supplementation and to spawning by precocial (2 year old) hatchery-reared females (Smith 1995b, 1998a). However, severe storms in 1998 probably destroyed most 1998 redds and caused severe overwinter mortality of 1997 year class coho, severely reducing both year classes. In addition, a single severe storm in 2000 occurred immediately after most spawning probably occurred, further reducing the 2000 year class (Smith 2000b). Similar events apparently severely impacted the 2000 coho year class in Redwood Creek (Smith 2000a), more than 60 miles away. Since all local coho streams show a similar pattern, weak or absent year classes cannot presently be restored by strays among adjacent streams. Restoring year classes might be possible if the Scott Creek populations are gradually rebuilt by returns of hatchery-reared precocial fish.

In 1993 hatchery-reared fry from Scott Creek were planted in Gazos Creek at several locations upstream of Old Woman's Creek (Cloverdale Road). Except for fish of unknown origin in 1993, the overwhelming majority of juvenile coho captured in Gazos Creek have been from sites between miles 4.4 and 5.3 (Table 2). Adult coho apparently do not ascend the high gradient habitat adjacent to the Mountain Camp (mile 5.4+), as even in 1999, when juvenile coho were abundant downstream, no coho were caught in a deep complex pool near the bottom of the steep bedrock chutes.

Within sites on Gazos Creek, coho have been captured almost exclusively in relatively deep, complex pools. Sampling results in high coho density years on Scott Creek (1993, 1996, 1999) indicate that abundant coho will also make some use of shallower, simpler habitats, but are able to suppress YOY steelhead in pools (Smith 1994a, 1996b, 1999). In 1998 on Gazos, Scott and Waddell creeks most of the scarce juvenile coho captured were at or near logjams that would have protected newly-emerged fry from the heavy spring flows that occurred that year (Smith 1998b).

Since coho primarily use pools their density is apparently relatively insensitive to year to year and site to site variation in summer stream flow (Smith 2000a). In Scott Creek and Redwood Creek juvenile coho have been common at sites with intermittent flow between pools (Smith 1994c, 1996a) and regularly use sites with late summer flows of less than 0.05-0.10 cfs (Smith 1994a, 1996a, 1996b).

Data Gaps

Juvenile steelhead are present in Bear Gulch, a small incised tributary at Mile 5.2, but the stream has not been walked to determine the extent of accessible spawning and YOY steelhead rearing habitat. Steelhead, but not coho, probably occasionally ascend the steeper portions of the North Fork of Gazos Creek upstream of the upper sample site (mile 5.45), including the bedrock falls on the North Fork at its junction with the South Fork. However, the extent and upstream limit of their use is not known. Since the steeper upper reaches probably (also?) contain resident rainbow trout, confirmation for or against steelhead use may depend upon finding clearly impassable barriers or upon observations of adults in winter or fish with color changes associated with smolting in spring.

The tiny lagoon at the mouth of Gazos Creek is very shallow when the sandbar is eroded in winter and spring. It is unlikely that any brackish water exists in the lagoon in spring to aid smolts in adapting to saltwater prior to entering the ocean. However, no salinity sampling has ever been conducted in spring. The lagoon has not been sampled in summer to determine the extent of juvenile steelhead rearing, but the sandbar rarely forms to provide impounded habitat before late summer. Limited surveys of the lagoon with an underwater viewer indicate little juvenile steelhead rearing occurs in summer. When the sandbar is in place the impounded lagoon can extend upstream to the streamside residence immediately upstream of Highway 1; this may create a problem from septic tank drainage at the residence.

Overwinter survival of juvenile coho and steelhead is probably an important limiting factor, especially in wet years. Therefore, maintaining and increasing complex pool and backwater habitat (including logjams) should be an important goal. However, there has been no winter and spring sampling to determine rate of loss of marked fish, because of permit restrictions on electroshock sampling while adults may be in the stream. Spring smolt trapping might be permitted, but the efficiency probably varies too sharply with stream flow to provide reliable year to year indices of winter survival.

LITERATURE CITED

Shapovalov, L. and A. C. Taft. 1954. The life histories of the steelhead rainbow trout (*Salmo gairdneri gairdneri*) and silver salmon (*Oncorhynchus kisutch*). California Department of Fish and Game Bulletin 98. 275 pp.

Smith, J. J. 1990. The effects of sandbar formation and inflows on aquatic habitat and fish utilization in Pescadero, San Gregorio, Waddell and Pomponio creek estuary/lagoon systems, 1985-1989. Report to the California Department of Parks and Recreation. 96 pp.

Smith, J. J. 1992. Distribution and abundance of juvenile coho and steelhead in Waddell, Scott and Gazos creeks in 1992. 8 page unpublished report.

Smith, J. J. 1994a. Distribution and abundance of juvenile coho and steelhead in Waddell, Scott and Gazos creeks in 1993. 15 page unpublished report.

Smith, J. J. 1994b. Abundance of coho and steelhead in Redwood Creek in 1994. Report to Golden Gate National Recreation Area, National Park Service. 10 pp.

Smith, J. J. 1994c. Distribution and abundance of juvenile coho and steelhead in Scott and Waddell creeks in 1988 and 1994: implications for status of southern coho. 12 page unpublished report.

Smith, J. J. 1995a. Distribution and abundance of coho and steelhead in Redwood Creek in August 1995. Report to Golden Gate National Recreation Area, National Park Service. 9 pp.

Smith, J. J. 1995b. Distribution and abundance of coho and steelhead in Gazos, Waddell and Scott creeks in 1995. 20 page unpublished report.

Smith, J. J. 1996a. Distribution and abundance of coho and steelhead in Redwood Creek in November 1996. Report to Golden Gate National Recreation Area, National Park Service. 9 pp.

Smith, J. J. 1996b. Distribution and abundance of juvenile coho and steelhead in Gazos, Waddell and Scott creeks in 1996. 26 page unpublished report.

Smith, J. J. 1997. Distribution and abundance of coho and steelhead in Redwood Creek in Fall 1997. Report to Golden Gate National Recreation Area, National Park Service. 9 pp.

Smith, J. J. 1998a. Distribution and abundance of juvenile coho and steelhead in Gazos, Waddell and Scott creeks in 1997 and the implication for status of southern coho. 23 page unpublished report.

Smith, J. J. 1998b. Distribution and abundance of coho and steelhead in Redwood Creek in Fall 1998. Report to Golden Gate National Recreation Area, National Park Service. 12 pp.

Smith, J, J. 1998c. Distribution and abundance of juvenile coho and steelhead in Gazos, Waddell and Scott creeks in 1998. 27 page unpublished report.

Smith, J. J. 1999. Distribution and abundance of juvenile coho and steelhead in Gazos, Waddell and Scott creeks in 1999. 26 page unpublished report.

Smith, J. J. 2000a. Distribution and abundance of coho and steelhead in Redwood Creek in Fall 2000. Report to Golden Gate National Recreation Area, National Park Service. 8 pp.

Smith, J. J. 2000b. Distribution and abundance of juvenile coho and steelhead in Gazos, Waddell and Scott creeks in 2000. 20 page unpublished report.

Smith, J. J. and L. Davis. 1993. Distribution and abundance of juvenile coho and steelhead in Waddell Creek in 1993. 7 page unpublished report.

Smith, J. J. and H. W. Li. 1983. Energetic factors influencing the foraging tactics of juvenile steelhead trout *Salmo gairdneri*. D. L. G. Noakes, et al. (4 eds.) Predators and Prey in Fishes. Dr. W. Junk Publishers, the Hague. pp 173-180.

Table 1. Density of steelhead (# / 100 feet sampled) for sites at Gazos Creek in 1992-2001. Value in () is density of yearling and older fish.

Site	Mile > Hwy 1	1992	1993	1995	1996	Year Class 1997	1998	1999	2000	2001	Mean
1	0.9	20(14)	16(11)	57(22)	21(13)	15(8)	24(7)	15(3)	14(7)	23(10)	23(11)
2	1.8	30(9)	22(12)	52(12)	28(11)	22(11)	45(10)			33(10)	35(11)
	2.05 Old Woman's Creek										
2A	2.1				31(14)	39(11)	53(7)	49(9)	28(8)	52(14)	42(11)
2B	2.8							82(11)	32(4)	42(5)	52(7)
3	3.15		25(5)	96(11)	44(10)	23(2)	64(3)	71(8)	30(4)	63(9)	52(7)
3A	3.9							37(7)		71(11)	54(9)
4	4.4		53(9)	68(10)	46(9)	80(9)	69(4)		56(6)		67(9)
	4.4/4.6							94(6)		65(13)	
5	4.8/5.0						37(8)				31(7)
	4.85							30(6)	34(7)	21(8)	
6	5.1/5.2						67(9)				67(9)
7	5.3/5.45						61(8)				49(9)
7A	5.3							48(8)	66(8)	20(11)	
7B	5.45							80(17)			80(17)
Total		24(12)	29(9)	68(14)	34(12)	36(8)	53(7)	51(8)	37(6)	45(11)	41(10)

Table 2. Density of coho (#/100 feet sampled) for sites at Gazos Creek in 1992-2000. Coho densities in 1996 were augmented by hatchery-spawned fry.

		Year Class									
Site	Mile > Hwy 1	1992	1993	1995	1996	1997	1998	1999	2000	2001	Mean
1	0.9	0	0	0	0.6	0	0	0	0	0	0.1
2	1.8	0	0	0.8	0.9	0	0.6			0	0.4
	2.05 Old Woman's Creek										
2A	2.1				8	0	0	0	0	0	1.3
2B	2.8							3	0	0	1.0
3	3.15		1	0	7	0	0	0.5	0	0	1.0
3A	3.9							0.7		0	0.4
4	4.4		23	0	8	0	0		0		5.1
	4.4/4.6							10		0	
5	4.8/5.0						0				3.3
	4.85							13	0	0	
6	5.1/52						2.7				2.7
7	5.3/5.45						0				7.0
7A	5.3							28	0	0	
7B	5.45							0			0
Total		0	6.0	0.2	4.9	0	0.4	6.2	0	0	2.0
% of sites w/coho		0	50	25	100	0	25	67	0	0	30

Figure 1. Standard lengths (mm) of YOY steelhead from sites on Gazos Creek in September and October 2000.

	Site 1 mile 0.9	Site 2A mile 2.1	Site 2B mile 2.8	Site 3 mile 3.15	Site 4 mile 4.4	Site 5 mile 4.8	Site 7 mile 5.3
45 – 49					**1	1	*7
50 – 54				***9	****24	**8	******32
55 – 59	1	*4	*3	******18	****22	******18	********40
60 – 64		***10	**7	***10	**13	**8	****24
65 – 69	*3	****13	*****16	**7	*7	*5	**13
70 – 74	****12	**8	**6	*5	*5	*3	*5
75 – 79	*4	**6	2	2		1	4
80 – 84	1	1	2				4
85 – 89	2						3

Figure 2. Standard lengths (mm) of YOY steelhead from sites on Gazos Creek in September 2001.

	Site 1 mile 0.9	Site 2A mile 2.1	Site 2B mile 2.8	Site 3 mile 3.15	Site 4 mile 4.4	Site 5 mile 4.8	Site 7 mile 5.3
30 – 34				1			
35 – 39				*8	*8	1	
40 – 44		*6	**6	******32	***16	*5	
45 – 49		**12	**6	*******39	*******38	*3	2
50 – 54	*5	*****26	***9	*****28	*****26	**6	*******20
55 – 59	******19	***16	**6	***19	**14	*5	***11
60 – 64	****12	**10	***11	*5	4	*4	****13
65 – 69	***9	*8	*5	4	1		**6
70 – 74	*4	2	2	1			2

Figure 3. Standard Lengths (mm) of YOY steelhead at downstream (sites 1&2) and upstream (site 4) sites on Gazos Creek from 1995 to 2001.

	Sites 1&2 1995	Sites 1&2 1997	Sites 1&2 1998	Site 1 1999	Site 1 2000	Site 1 2001
40 – 44		2	1			
45 – 49		2	******18			
50 – 54	2	****13	*********28			*5
55 – 59	****12	******18	******18		1	******19
60 – 64	*******22	****13	***********33	*3		****12
65 – 69	********24	**6	****12	***9	*3	***9
70 – 74	****12	***11	*3	***11	****12	*4
75 – 79	****14	**6	*3	***11	*4	
80 – 84	****12	2		*3	1	
85 – 89	**6			*3	2	

	Site 4 1995	Site 4 1997	Site 4 1998	Site 4 1999	Site 4 2000	Site 4 2001
30 – 34		2		1		
35 – 39	2	*5	1	2		*8
40 – 44	**6	****14	****14	****23		***16
45 – 49	****13	****13	***********33	*******39	***10	*******38
50 – 54	*****15	******20	********25	****27	********24	*****25
55 – 59	***9	****14	*****17	****21	*******22	**14
60 – 64	*5	****12	**7	***16	****13	4
65 – 69		*4	*4	*5	**7	1
70 – 74					**6	